

Course Modules in Risk Based Materials Corrosion Education

Executive Summary

This project relies on the extensive nuclear safety and materials degradation experience of the University of Maryland (UMD) nuclear engineering faculty. The project also builds on the faculty's experience in corrosion and stress corrosion research. The University of Maryland offers Master of Science and Doctorate degree programs in Nuclear Science and Engineering (NSE). Its multi-disciplinary faculty associated with the program (five in total, plus three affiliated) provide the required depth of knowledge to its graduates who are entering a career in nuclear engineering and to practicing engineers seeking to enhance and extend their capabilities in Nuclear Science and Nuclear Engineering. Research is actively pursued in risk and reliability assessment of nuclear systems, complex system safety and maintainability and failure mechanisms associated with the radiation environment. The development of corrosion modules presents a close fit with the program's educational objectives.

The proposal is based on the development of three separate course modules for direct insertion into existing courses. The course modules can exist as separate short courses, or packaged together into a new course on "Corrosion Degradation."

1. New Course Modules Insertions. The new course module on probabilistic risk assessment of corrosion and risk prediction methods of corrosion will be developed for direct insertion into two existing courses: namely "Probabilistic Risk Assessment and Risk Management" and "Materials Degradation." The second course module will be the laboratory section to Materials Degradation including a hands-on corrosion testing experience which will enhance the student's educational experience. The third course module will address the basic understanding of the physics of failure of the corrosion phenomena. The course modules will be a combination of video presentations, PowerPoint presentations, and special lecture notes which will be made available to current and future students.

2. New Course Developments. A new course will be developed which will instruct students at the graduate level the basics of materials-environment interactions. The course outline includes: liquid-solid interactions, direct dissolutions mechanisms, electrochemical corrosion, the kinetics of corrosion, and corrosion prevention. Gas-solid interactions will emphasize the reaction products, kinetics, and wear mechanisms. This course will introduce the student to specific examples of corrosion modeling as well as failure analysis and in-situ corrosion testing within an environmental scanning electron microscope. In the proposed course the students will learn how to prevent the corrosion, what risk factors should be used to assess safety, and how to decide when a reactor shutdown is warranted. The new course will consist of all or sections of the above three modules.

3. Implementation and Distance Delivery. UMD's well-established web-based delivery system will be streamlined to offer the proposed courses to a broad audience of nuclear industry professionals, including web-based access for the interested NRC and DOE staff. As part of this proposal, the new online MS degree program will now include the new courses and will be fully online during academic year 2010-2011. The courses developed online will also be integrated within the new online MS degree program in Sustainable Energy.

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